UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/625,321	07/23/2003	Peter Michael Edic	120521-2/YOD GERD:0052	7756

7590 10/04/2006

Patrick S. Yoder
FLETCHER YODER
P.O. Box 692289
Houston, TX 77269-2289

EXAMINER	
HO, ALLEN C	

ART UNIT	PAPER NUMBER
2882	

DATE MAILED: 10/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/625,321	EDIC ET AL.	
	Examiner	Art Unit	
	Allen C. Ho	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7,9-15,17-23,25 and 26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,9-15,17-23,25 and 26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 March 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20060801*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 9, 17, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morgan (U. S. Patent No. 6,229,870 B1) in view of Casey *et al.* (U. S. Patent No. 5,175,754).

With regard to claim 1, Morgan disclosed a method for acquiring a projection data set, comprising: rotating a distributed x-ray source (**B**) about a volume of interest, wherein the distributed x-ray source comprises a plurality of addressable x-ray focal spots (column 5, line 53 - column 6, line 3); emitting x-rays from the distributed x-ray source; and acquiring (**14**) a projection data set comprising a plurality of projections generated from the emitted x-rays.

However, Morgan failed to disclose that the rotational period of the distributed x-ray source is greater than eight seconds.

Casey *et al.* disclosed a commercial CT that has a rotational period of eight seconds (column 1, lines 64-66). Casey *et al.* taught that the number of projections acquired per revolution is determined by the rotational period of the x-ray source. Since the quality of the reconstructed image depends on the number of acquired projections, it is obvious that a longer rotational period would yield better images (column 1, lines 61-62).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to rotate the distributed x-ray source with a rotational period greater than eight seconds, since a person would be motivated to obtain a high quality image by acquiring more projections at a higher angular resolution.

With regard to claim 9, Morgan and Casey *et al.* disclosed the method as recited in claim 1.

However, Morgan and Casey *et al.* failed to disclose a computer program provided on one or more computer readable media, the computer program comprises routines that implement the method as recited in claim 1.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide the method in the form of a computer program, since a person would be motivated to implement the method on a CT system that is controlled by a computer.

With regard to claim 17, Morgan disclosed a CT image analysis system, comprising: a distributed x-ray source (**B**) disposed on a gantry (**C**), wherein the distributed x-ray source comprises a plurality of addressable x-ray focal spots (column 5, line 53 - column 6, line 3); a detector (**14**) comprising a plurality of detector elements; a system controller (**16**) configured to control the x-ray source and to acquire a set of projection data during one or more rotations of the x-ray source about a dynamic object from one or more of the detector elements via a data acquisition system (**18**); and a computer system (**18**) configured to receive the set of projection data.

However, Morgan failed to disclose that the rotational period of the distributed x-ray source is greater than eight seconds.

Casey *et al.* disclosed a commercial CT that has a rotational period of eight seconds (column 1, lines 64-66). Casey *et al.* taught that the number of projections acquired per revolution is determined by the rotational period of the x-ray source. Since the quality of the reconstructed image depends on the number of acquired projections, it is obvious that a longer rotational period would yield better images (column 1, lines 61-62).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the distributed x-ray source to rotate with a rotational period greater than eight seconds, since a person would be motivated to obtain a high quality image by acquiring more projections at a higher angular resolution.

With regard to claim 25, Morgan disclosed a CT image analysis system, comprising: means for rotating a distributed x-ray source (**B**), wherein the distributed x-ray source comprises a plurality of addressable x-ray focal spots (column 5, line 53 - column 6, line 3); means for emitting x-rays from a portion of the distributed x-ray source; and means (**18**) for acquiring a projection data set comprising a plurality of projections generated from the emitted x-rays.

However, Morgan failed to disclose that the rotational period of the distributed x-ray source is greater than eight seconds.

Casey *et al.* disclosed a commercial CT that has a rotational period of eight seconds (column 1, lines 64-66). Casey *et al.* taught that the number of projections acquired per revolution is determined by the rotational period of the x-ray source. Since the quality of the reconstructed image depends on the number of acquired projections, it is obvious that a longer rotational period would yield better images (column 1, lines 61-62).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the gantry to rotate about a volume of interest for eight or more seconds, since a person would be motivated to obtain a high quality image by acquiring more projections at a higher angular resolution.

3. Claims 2-5 and 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morgan (U. S. Patent No. 6,229,870 B1) and Casey *et al.* (U. S. Patent No. 5,175,754) as applied to claims 1 and 9 above, and further in view of Yamagishi (U. S. Patent No. 5,383,231).

With regard to claims 2 and 10, Morgan and Casey *et al.* disclosed the method and the computer program as recited in claims 1 and 9, respectively.

However, Morgan and Casey *et al.* failed to disclose a method that comprises the steps of generating a set of interpolated projections by interpolating the projection data set using a set of concurrently acquired phase data and frequency content of the projection data set, wherein each interpolated projection characterizes the projection data set at a view location of the distributed x-ray source and at a particular time; and reconstructing the set of interpolated projections to generate one or more images.

Yamagishi disclosed a method for acquiring a CT image of a heart, comprising the steps of generating (**13**) a set of interpolated projections by interpolating the projection data set using a set of concurrently acquired phase data (**12**) and frequency content of the projection data set (the projection data set are acquired at a frequency or time interval), wherein each interpolated projection characterizes the projection data set at a view location of a distributed x-ray source and at a particular time; and reconstructing (**13**) the set of interpolated projections to generate one or more images (column 5, line 53 - column 6, line 30). Yamagishi taught this method is

capable of obtaining a three-dimensional image of a heart without motion artifacts (column 2, lines 30-36).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to generate a set of interpolated projections by interpolating the projection data set using a set of concurrently acquired phase data and frequency content of the projection data set and to reconstruct the set of interpolated projections to generate one or more images, since a person would be motivated to obtain a three-dimensional image of a heart without motion artifacts for diagnosis.

With regard to claims 3 and 11, Morgan, Casey *et al.*, and Yamagishi disclosed the method and the computer program as recited in claims 2 and 10, respectively, further comprising associating two or more images to generate a volume rendering (Morgan **22**).

With regard to claims 4 and 12, Morgan, Casey *et al.*, and Yamagishi disclosed the method and the computer program as recited in claims 2 and 10, respectively, wherein the volume of interest comprises a heart having a cardiac period (Yamagishi).

With regard to claims 5 and 13, Morgan, Casey *et al.*, and Yamagishi disclosed the method and the computer program as recited in claims 4 and 12, respectively.

However, Morgan, Casey *et al.*, and Yamagishi failed to disclose a rotational period is approximately a multiple of the cardiac period.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to set a rotational period that is approximately a multiple of the cardiac period, since a person would be motivated to acquire projection data set that comprises several complete cardiac periods.

4. Claims 6, 7, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morgan (U. S. Patent No. 6,229,870 B1), Casey *et al.* (U. S. Patent No. 5,175,754), and Yamagishi (U. S. Patent No. 5,383,231) as applied to claims 2 and 10 above, and further in view of Taguchi (U. S. Patent No. 6,466,640 B1).

With regard to claims 6 and 14, Morgan, Casey *et al.*, and Yamagishi disclosed the method and the computer program as recited in claims 2 and 10, respectively.

However, Morgan, Casey *et al.*, and Yamagishi failed to teach that the step of interpolating the projection data set comprises reducing statistical noise in the projection data set.

Taguchi disclosed a method of interpolating the projection data set that reduces statistical noise in the projection data set (column 15, lines 4-34).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to reduce statistical noise during interpolation, since a person would be motivated to obtain an image without noise.

With regard to claims 7 and 15, Morgan, Casey *et al.*, Yamagishi, and Taguchi disclosed the method and the computer program as recited in claims 6 and 14, respectively, further comprising reducing an x-ray dose applied to the volume of interest in response to the reduction in statistical noise (column 15, lines 4-34).

5. Claims 18-21 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morgan (U. S. Patent No. 6,229,870 B1) and Casey *et al.* (U. S. Patent No. 5,175,754) as applied to claims 17 and 25 above, and further in view of Yamagishi (U. S. Patent No. 5,383,231).

With regard to claim 18, Morgan and Casey *et al.* disclosed the CT image analysis system as recited in claim 17.

However, Morgan failed to disclose a computer system configured to generate a set of interpolated projections by interpolating the set of projection data using a set of concurrently acquired phase data and the frequency content of the set of projection data, wherein each interpolated projection characterizes the projection data set at a view location of the distributed x-ray source and at a particular time and to reconstruct the set of interpolated projections to generate one or more images.

Yamagishi disclosed a computer system (**13**) that generates a set of interpolated projections by interpolating the projection data set using a set of concurrently acquired phase data (**12**) and frequency content of the projection data set (the projection data are acquired at a frequency or time interval), wherein each interpolated projection characterizes the projection data set at a view location of a distributed x-ray source and at a particular time; and reconstructs the set of interpolated projections to generate one or more images (column 5, line 53 - column 6, line 30). Yamagishi taught this computer system is capable of obtaining a three-dimensional image of a heart without motion artifacts (column 2, lines 30-36).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide a computer system disclosed by Yamagishi, since a person would be motivated to obtain a three-dimensional image of a heart without motion artifacts for diagnosis.

With regard to claim 19, Morgan, Casey *et al.* and Yamagishi disclosed the CT image analysis system as recited in claim 18, wherein the computer system is further configured to associate two more images to generate a volume rendering (Morgan **22**).

With regard to claim 20, Morgan, Casey *et al.*, and Yamagishi disclosed the CT image analysis system as recited in claim 18. Claim 20 fails to set forth additional structural limitation. Consequently, claim 20 is rejected with claim 18. MPEP § 2115.

With regard to claim 21, Morgan, Casey *et al.*, and Yamagishi disclosed the CT image analysis system as recited in claim 20, wherein a rotational period of the distributed x-ray source is approximately a multiple of a cardiac period (a cardiac period is approximately one second).

With regard to claim 26, Morgan and Casey *et al.* disclosed the CT image analysis system as recited in claim 25.

However, Morgan and Casey *et al.* failed to disclose means for generating a set of interpolated projections using a set of concurrently acquired phase data and the frequency content of the projection data set, and means for reconstructing the set of interpolated projections to generate one or more images.

Yamagishi disclosed means (**13**) for generating a set of interpolated projections by interpolating the projection data set using a set of concurrently acquired phase data (**12**) and frequency content of the projection data set (the projection data are acquired at a frequency or time interval), wherein each interpolated projection characterizes the projection data set at a view location of the gantry and at a particular time; and means (**13**) for reconstructing the set of interpolated projections to generate one or more images (column 5, line 53 - column 6, line 30). Yamagishi taught these means are capable of obtaining a three-dimensional image of a heart without motion artifacts (column 2, lines 30-36).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide means for generating a set of interpolated projections and means

for reconstructing the set of interpolated projections to generate one or more images disclosed by Yamagishi, since a person would be motivated to obtain a three-dimensional image of a heart without motion artifacts for diagnosis.

6. Claims 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morgan (U. S. Patent No. 6,229,870 B1), Casey *et al.* (U. S. Patent No. 5,175,754), and Yamagishi (U. S. Patent No. 5,383,231) as applied to claim 18 above, and further in view of Taguchi (U. S. Patent No. 6,466,640 B1).

With regard to claim 22, Morgan, Casey *et al.*, and Yamagishi disclosed the CT image analysis system as recited in claim 18.

However, Morgan, Casey *et al.*, and Yamagishi failed to disclose a computer system configured to generate a set of interpolated projections, wherein generating a set of interpolated projections reduces statistical noise in the set of projection data.

Taguchi disclosed a method of interpolating the projection data set that reduces statistical noise in the projection data set (column 15, lines 4-34).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the computer system to reduce statistical noise during interpolation, since a person would be motivated to obtain an image without noise.

With regard to claim 23, Morgan, Casey *et al.*, Yamagishi, and Taguchi disclosed the CT image analysis system as recited in claim 22, wherein the computer system is further configured to reduce an x-ray dose applied to the volume of interest in response to the reduction in statistical noise (column 15, lines 4-34).

Response to Arguments

7. Applicant's arguments filed 31 July 2006 with respect to claims 17-23 have been fully considered and are persuasive. The rejection of claims 17-23 under 35 U.S.C. 112, second paragraph, has been withdrawn.

8. Applicant's arguments filed 31 July 2006 with respect to claims 17 and 25 have been fully considered and are persuasive. The rejection of claims 17 and 25 under 35 U.S.C. 102(b) has been withdrawn.

9. Applicant's arguments filed 31 July 2006 have been fully considered but they are not persuasive.

The applicants argue that there is no motivation to have a rotational period greater than eight seconds. Specifically, the applicants argue that a longer rotational period is required in only limited circumstances when not imaging a moving organ. This argument is not persuasive because this argument confirms the need to have a longer rotational period when imaging a non-moving object.

The applicants argue that one of ordinary skill in the art would not trade shorter scan time for higher resolution. The examiner respectfully disagrees. To obtain useful diagnostic images, the resolution of the image must be less than the size of the region of interest. A low-resolution image would not be able to resolve the features of a small region of interest, thereby rendering the image useless for diagnosis.

The applicants argue that there is no evidence that a CT described by Casey *et al.* is capable of acquiring more than 7,872 projection data in one revolution. The examiner respectfully disagrees. First of all, the disclosure by Casey *et al.* is only relied upon to teach the

relationship between the rotational period and the resolution of the image. That is, acquiring more projection data in one revolution, which requires a longer rotational period, results in an image of higher resolution. Second, a person skilled in the art would configure a CT to acquire and/or process additional projection data if a high-resolution image is deemed necessary.

The applicants argue that there is no motivation to combine the disclosures of Morgan and Casey *et al.* Specifically, the applicants argue that Morgan taught away from using an x-ray source with a rotational period longer than eight seconds. The examiner respectfully disagrees. Morgan disclosed a computed tomography system that comprises a distributed x-ray source, which emits multiple fan beams. This computed tomography system is designed to acquire multiple slices simultaneously, thereby reducing the total scan time required to acquire multiple slices that would otherwise have to be acquired sequentially. The simultaneous multi-slice data acquisition disclosed by Morgan is different from the issue of rotational period discussed by Casey *et al.* because Morgan taught reducing the scan time for acquiring multiple slices, not an individual slice.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allen C. Ho whose telephone number is (571) 272-2491. The examiner can normally be reached on Monday - Friday from 8:00 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Allen C. Ho

Allen C. Ho, Ph.D.
Primary Examiner
Art Unit 2882

29 September 2006